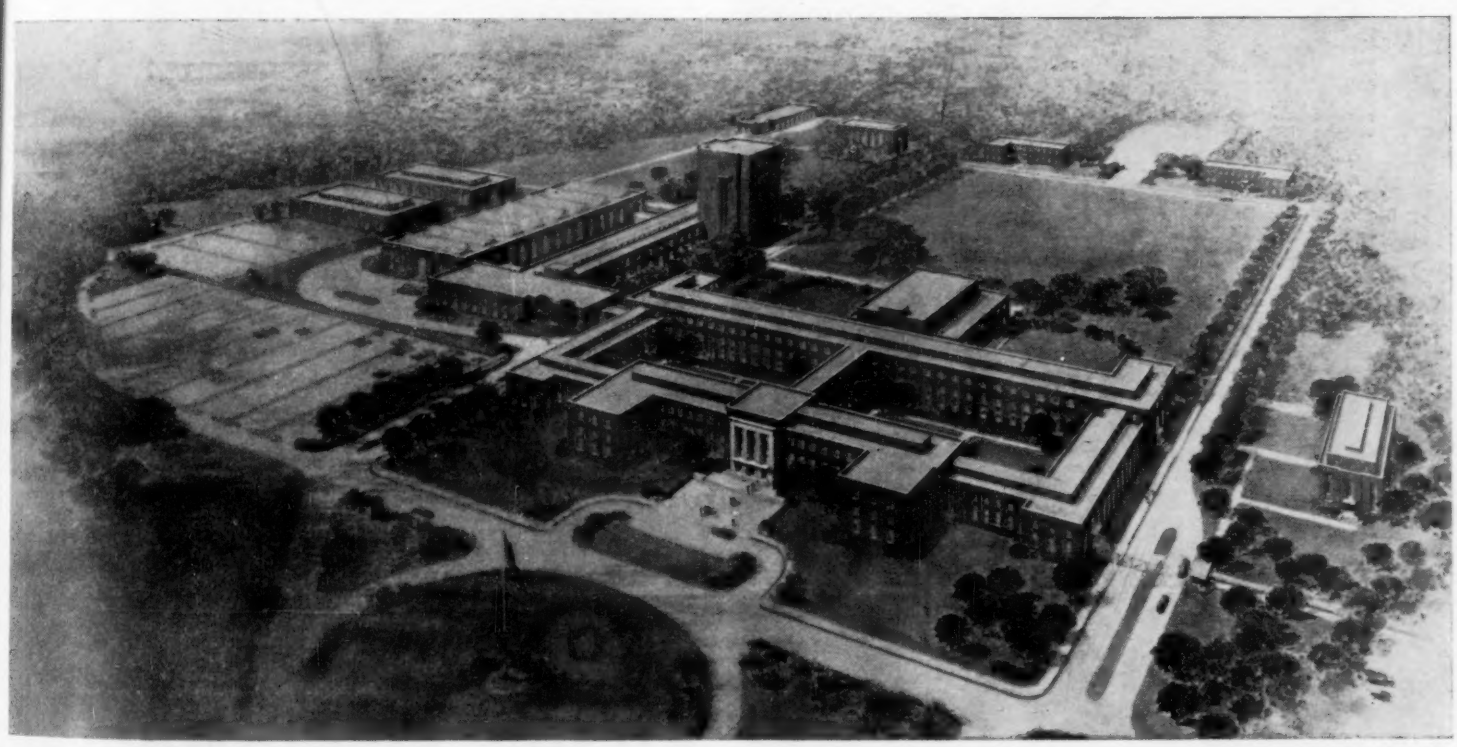
VOL. 104 NO. 2698 *Friday, 13 September 1946* PAGES 237-258

SCIENCE

In This Issue



Architect's Rendering of the New Naval Ordnance Laboratory, White Oak, Maryland

Published by the

American Association for the Advancement of Science

113th AAAS Meeting—Boston, 26-31 December 1946

EIMER AND AMEND

Tested Purity REAGENTS—

COMPLY WITH

A. C. S.

SPECIFICATIONS

The exact analysis is stated on the label of each bottle of Eimer and Amend Tested Purity Reagents.

E & A Tested Purity Reagents and other laboratory chemicals can be obtained along with modern apparatus and various laboratory supplies on the same order from New York, Pittsburgh or St. Louis.

EIMER AND AMEND

Greenwich and Morton Streets
New York (14), New York

Fisher Scientific Co.

717 Forbes St., Pittsburgh (19), Pa.
2109 Locust St., St. Louis (3), Mo.

SCIENCE

Vol. 104, No. 2698 Friday, 13 September 1946

The Naval Ordnance Laboratory

White Oak, Maryland

CORNERSTONE CEREMONIES for the new Naval Ordnance Laboratory took place on 15 August with the Honorable James Forrestal, Secretary of the Navy, and Captain F. S. Withington, Officer-in-Charge, officiating. This project, which was started in 1944, provides some 600,000 square feet of working area and is located on a 938-acre site in the White Oak-Hillandale section of Maryland, about 12 miles from the center of the District of Columbia.

The Naval Ordnance Laboratory is a naval field establishment, operating under the cognizance of the Bureau of Ordnance of the Navy Department. Headed by a naval officer, with a complement of approximately 2,000, most of whom are civilians, it is charged by the Navy with responsibility for research, development, design, and testing of mines, depth charges, fuses, torpedo mechanisms, pyrotechnics, ammunition components, influence devices, and other related items of Naval Ordnance. The projects range from small simple mechanical devices to large complex mechanisms of extreme sensitivity employing advanced electronic designs. Work on these devices proceeds from pure research on the basic principles, through the applied science of design, development, and testing, to the engineering of production and the training of personnel in the use and maintenance of the weapons.

The Laboratory plant at White Oak will comprise about 50 permanent buildings, including a main Administration and Laboratory Building, Auditorium and Cafeteria Building, Magnetic Group, Ammunition Group, Ballistics and Supersonic Aerodynamics Group, the Plastics Laboratory, the Test Laboratory, shop, barracks, warehouse, boiler plant, and other service structures. Most of the buildings will be air-conditioned, and many will be interconnected with pedestrian tunnels. Movable, soundproof steel partitions, placed at 11-foot intervals, will be used in the main buildings. Services, such as 120/208-volt, 3-phase, 4-wire alternating current, 120/240-volt direct current, hot and cold water, compressed air, gas, steam, and acid waste, can be made available in service shafts spaced every 22 feet. Lighting will be fluorescent with an intensity of 35 foot-candles. The equipment accumulated during the war years plus much new equipment, need for which has been demonstrated, will be installed.

Special features in the Test Laboratory consist of a series of controlled temperature chambers, the largest of which is $8 \times 8 \times 40$ feet, with temperatures ranging from $-80°$ F. to $+180°$ F.; a pressure vessel 8 feet in diameter and 38 feet long, handling pressures up to 1,000 pounds per square inch; vibration test equipment; a model tank; and many other varieties of physical test equipment. The Magnetic Group consists of seven buildings of entirely nonmagnetic construction, even to the exclusion of red brick (because of the iron oxide). One building, the Quiet Laboratory, contains no electric lights, water pipes, permanent heating equipment, or other ordinary facilities which might interfere with magnetic studies at low intensities or high frequencies. The Ballistics Laboratory-Wind Tunnel Group consists of a Ballistic Research Laboratory containing laboratories and offices, a Ballistic Range Building containing seven firing ranges, and a Wind Tunnel Building housing the supersonic wind tunnels brought to this country from Kochel, Germany, where prior to their capture they had been used on guided missile and ballistics research. Included in the extensive acoustic laboratories is an anechoic room of unusual size.

Under the Officer-in-Charge, Captain F. S. Withington, and the Technical Director, Captain R. D. Bennett, the Laboratory is organized into seven departments: Research, Engineering, Test, Technical Services, General Services, Personnel, and Supply. Each department in turn is broken down into divisions. Thus, under Research is included the Electricity and Magnetism, Acoustics, Mechanics (aerodynamics, hydrodynamics, external ballistics, terminal ballistics), Explosive Phenomena, Physical Optics, and Ordnance Research Divisions. The Engineering Department is made up of the Ammunition, Mine and Depth Charge, Torpedo, Plastics, and V-T Fuse Divisions. The Test Department includes the Electrical, Mechanical, Ord-

nance Evaluation, and Field Test Divisions. Under the latter are included field stations at Hiwassee Dam, North Carolina; Fort Monroe, Virginia; Provincetown, Massachusetts; Solomons, Maryland; and Dahlgren, Virginia. Under the Technical Services Department are the Analysis and Publications, Design and Drafting, Industrial Engineering, Library, Technical Museum, Patent, Photographic, Property Control, and Shop Divisions. The General Services Department consists of the Administrative, Communications, Maintenance, Operations, and Plant Engineering Divisions. The Personnel Department is made up of the Employment, Classification, Naval Personnel, Employee Services, Research and Records, and Training Divisions. The last-mentioned division trains naval personnel in ordnance devices, supervises numerous inservice courses, cooperates with universities with graduate courses and theses, and gives training in administration and organization of research laboratories.

One of the duties of the Laboratory will be to maintain continuous and active research and development of new principles and devices. Efforts are being made to incorporate here the best features of industrial and university laboratories in order that the Nation may have the protection of the last word in scientific development.

Fifty Years of Physics—A Study in Contrasts

Gordon Ferrie Hull
Dartmouth College, Hanover, New Hampshire

IN THE DOMAIN OF PHYSICS there have been two transcendent periods during these past 50 years. The first began in 1895–96 with the discovery of X-rays, followed by the discovery of the Becquerel rays in 1896, the electron in 1897, radium in 1898, and the statement of the quantum theory by Planck in 1900. The second period also began in 1896, but, growing slowly, culminated in 1939. Vast vistas were suddenly opened in 1896. There had been no theory or experiment which had foretold or prepared us for the discovery of X-rays. It came out of the blue. A similar statement may be made concerning radioactivity and the quantum idea. The timeliness of the discovery of X-rays and the electron is shown by the fact that two of the three kinds of rays which came from a complex radioactive source could be explained at once. The nature of the third ray, though quickly postulated by the keen intuition of Rutherford, was not convincingly established until the Rutherford and Royds experiment in 1908, when the process of transmutation of the elements as it occurs in nature was made plain and the way opened for all the vast results which have followed.

My purpose is not to attempt to record the progress of physics in all its great domains during these years but to present here only a few contrasts.

Upon a previous occasion[1] I called attention to the fact that no American physicist participated in any of the great discoveries which have been mentioned. Perhaps that statement should be modified, as will later be indicated.

In 1899 Arthur Gordon Webster, a distinguished Harvard graduate and one of our most prominent physicists, called together the leading physicists, chiefly of the East, for the purpose of organizing the American Physical Society. Appropriately, Henry Rowland was elected president, and A. A. Michelson, vice-president. In his address as retiring president, Rowland named, without initials or given names, four American physicists—only four—who in all the preceding history of America had won worldwide fame for their contribution to physics: Franklin, Rumford, Henry, and Mayer.

The many-sided Franklin, a legendary figure, had won fame along various lines. Had he not been famous as a publisher and a statesman, he might never have been heard of as a scientist. Balzac described him as "the inventor of the lightning rod, the hoax, and the republic." It has been maintained that there is no clear evidence that he ever performed the kite experiment, and it is certain that the experiment was performed elsewhere before Franklin wrote of it as a possibility. In any event, Franklin's work in science did not lack for publicity.

Rumford left America as a very young man. He was always a British subject and did all his scientific work in Europe. He could hardly be called an American scientist. He was, however, interested in the development of science in America as is evidenced by the Rumford Medal of the American Academy of Arts and Sciences, the Rumford Fund of that Academy, and the Rumford Professorship at Harvard.

Joseph Henry's work in electromagnetic induction

[1] The second Richtmyer Memorial Address of the American Association of Physics Teachers (*Amer. J. Physics*, 1943, 11, 23).

Based on an address delivered before the American Physical Society at Cambridge, Massachusetts, 27 April 1946.

was substantial but was overshadowed by the work of Faraday.

But who was Mayer? I have asked many physicists, but only one knew. Henry Crew knew Mayer personally and had visited his laboratory. A. M. Mayer (1836–1897) was professor of physics in Stevens Institute and was the co-author of a very modest text (112 pp.) on Light. His contribution to physics has not been recorded in any history of physics with which I am acquainted.

Rowland's list of American physicists who, before his time, had made substantial contributions boils down then to two names, Benjamin Franklin and Joseph Henry. Had he included living Americans he would have added two more, himself and A. A. Michelson. Rowland's experiment on the magnetic effect of convection currents, begun in Helmholtz' laboratory, made clear to J. J. Thomson the nature of the electron. To that extent an American physicist participated in the discovery of that particle. Rowland's exhaustive experiment on the mechanical equivalent of heat was financed by the Rumford Fund and his extensive paper was published in the proceedings of that Academy. He had had difficulty in finding an American publisher for some of his earlier papers. Clerk Maxwell came to his rescue and had them published in the *Philosophical Magazine*.

Coming then to the year 1900 we find that American physicists had made the contributions just mentioned. In addition, the concave grating had been designed; an excellent machine for ruling gratings (the machine which is still ruling gratings for the world) had been built; and the Michelson-Morley experiment—perhaps America's most important experiment—had been performed. In this, Michelson measured the French meter in wave lengths of cadmium light, carrying the experiment to a precision which has never been exceeded (1 part in 20,000,000).[2]

Fifty years ago graduate training in physics was looking up in America, but it was still true that every young physicist felt it was necessary to spend at least a year in Germany or in the Cavendish Laboratory in Cambridge. Europe was the source of inspiration. Not only our ideas, but 90 per cent of all apparatus in our physical laboratories, came from Europe, chiefly from Germany.

The leading laboratories in the United States were rapidly expanding, and two in Canada, Toronto and McGill, were being heard from. In 1898 the 27-year-old New Zealander, Rutherford, came from Cambridge to McGill as research professor in physics. Soddy, from Oxford, joined him in 1900. Together, in 1902, they put forth the startling theory that radioactivity was a spontaneous natural process of transmutation of certain elements. This idea seemed so preposterous that the authorities of McGill were afraid that the University would be held up to ridicule. But the physicists of the world were presently convinced that the theory was right, and McGill became a mecca for workers in radioactivity. Among those who came was Otto Hahn (1905), who, with Strassmann in January 1939, announced the experimental result which, as you all know, set the world on fire: Uranium atoms bombarded by slow neutrons break up so that barium is produced. Then the second volcanic eruption in physics, which had been gathering force for 40 years, suddenly exploded. The rest has been told in millions of words in our press and journals since 6 August 1945.

Although the "genealogical tree" of the radioactive products of uranium had been set forth in 1902 on the basis that the alpha particle was a helium atom of charge two and mass four, there was still doubt about it when Rutherford left McGill for Manchester in 1907. In a letter to Hahn in 1907 Rutherford writes that "it may yet turn out that the alpha particle is hydrogen and that helium comes from a rayless product." I made this proposal in 1904, when Rutherford lectured at Dartmouth, and doubtless numerous others made it. But within a year after reaching Manchester Rutherford and Royds proved the helium idea the right one. In the same letter to Hahn, Rutherford expressed pleasure at the prospect of getting back to England, for, he wrote: "I shall be glad to be nearer the scientific center as I always feel that America, as well as Canada, is on the periphery of the circle." What would he say now, with at least three-fifths of all the physics activity in the world centered in the United States?

The road from the discovery of radium in 1898 to that of the fission of uranium in 1939 was long. Hans Geiger had been an assistant of Prof. Schuster in Manchester and was retained as Rutherford's assistant. In 1908 we had the Rutherford and Geiger device for counting alpha particles. Later, in Germany, Geiger improved upon this device, and still later (1928) the Geiger-Müller counter was brought out. With this instrument electric currents may be measured to the absolute limit of smallness. A person may be given food containing radioactive atoms, and this counter may be utilized to discover where those atoms are chiefly concentrated at some later time in the body.

Rutherford for some time had been wondering about the structure of the atom—whether it was like the "pumpkin" atom of J. J. Thomson or whether it was a solar nucleus with electrons outside. Nagaoka had suggested a "saturnian" atom, a central massive por-

[2] This precision may in the future be surpassed by using the green line of the new isotope of mercury, but it will require a Michelson to perform the experiment.

tion with a ring of negative electrons. Rutherford worked out the theory of the scattering of alpha particles on the basis of the nuclear idea, and Geiger, later Geiger and Marsden (1912), tested the theory by counting the number of alpha particles scattered at various angles. Their results supported the nuclear idea. Niels Bohr spent some months in Manchester at this time and was quick to use the new picture of the atom in his famous theory of the spectra of hydrogen. Moseley, who was with Rutherford for three years, also confirmed the nuclear view and in 1913 established the concept of the atomic number, the number which has been used ever since to identify chemical elements. Let it be recalled again that Moseley, who had accomplished more in his brief lifetime than most scientists who live to three score years and ten, was killed at Gallipoli in August 1915 at the age of 27.

War now intervened to check ordinary scientific research. Rutherford, Hahn, and Geiger, who had gone back to Germany, corresponded during the war by roundabout methods, all letters showing continued respect and cordial good will. In contrast with this evidence of friendship, I have not heard of any friendly letters during World War II from a German scientist to a scientist outside Germany.

Chadwick carried on research with Geiger in Germany just before World War I. He was interned during the four years but was well treated. Geiger's letters to Rutherford always gave assurances to that effect.

Bohr, in a long letter to Rutherford in November 1918, wrote as follows: "All here are convinced there can nevermore be a war in Europe of such dimensions." Perhaps he was expressing not a conviction but a hope—a hope entertained by all scientists. But scientists in the past have had almost no place in the government of nations.

In 1919 Rutherford found that a nitrogen atom bombarded by an energetic alpha from radium could be transmuted into a new oxygen atom and hydrogen. The laborious method of observing the scintillations of a fluorescent screen was used to detect this result. For the first time in man's history the atom of a stable chemical element—the imperishable element of the chemists—was transmuted into another. The projectile used in this experiment was man directed, but not man made. It was a projectile provided by nature, and its initial energy could not be altered in any way by man. But if we could give great and various energies to various kinds of atoms, what might happen? Cockroft and Walton (1932) in the Cavendish Laboratory were able to speed up hydrogen nuclei to an energy of only 150,000 volts and, directing these against lithium, found that two helium atoms had been formed. Not only were new atoms formed, but apparently energy had been created, for the two helium nuclei together had an energy of 17,000,000 volts. The loss of mass due to the formation of the two new atoms had taken the form of energy—a concept which had been growing for some time. Einstein's historic equation, $E = mc^2$, had been verified. Then the race was on.

Now let us return to the Paleozoic age of physics in America, the formation of the American Physical Society. The Society started with 37 members. Some of these were not physicists but joined to show their good will. Everyone knew pretty nearly everyone else. There were to be four meetings a year, each meeting consisting of a morning and an afternoon session. At the first five meetings there was a total of 28 papers, three or four being given in the morning and three or four in the afternoon. There was plenty of time for the papers and for discussion. Also, a paper could hardly have been said to have received due consideration unless it had been discussed by two men, W. S. Franklin and A. G. Webster. Franklin, the intuitive, always wanted a model to picture the phenomenon under discussion, a model which in imagination he held in his hands and which he stretched, compressed, or twisted. He would quote Goethe to illustrate his point. This would be too much for Webster, who would quote Helmholtz, and also Homer and Virgil in the original, and would end up by giving an explanation completely satisfactory to himself in terms of x, y, and z. At times R. W. Wood, who had succeeded Rowland at Johns Hopkins (1901) and who was known throughout the world as a brilliant experimenter, gave demonstrations of optical phenomena. Here a tribute should be paid to Wood for his many contributions to optics, for his outstanding text on Physical Optics, for his near discovery of the Raman effect, and for his exposure of Blondlot's claims regarding N-rays.[3]

The proceedings and papers of the Society were published in bulletins, four per volume. Volume I, covering the first two years, had a total of 80 pages. But at Cornell University in 1894 E. L. Nichols and Ernest Merritt had started the *Physical Review*. This was taken over by the Society in January 1903. Since then, it has been the chief official publication and has become the foremost physics journal in the world.

Just before Rutherford left Canada in order to be near the center of things, O. W. Richardson came from Trinity College, Cambridge, to Princeton. The

[3] Blondlot, of the University of Nancy, in 1904 received a prize of 50,000 francs for the discovery of the N-rays. Wood visited his laboratory and removed in the semidarkened room some of the "essential" components of the apparatus. Blondlot still saw the screen light up. (See *J. Franklin Inst.*, 1907, **164**, 57, 113, 177.)

Comptons presently emerged from Princeton, and for a time it looked as though they were going to make the domain of physics a family reservation. Pupin and others were building up Columbia not only by their own work but by capturing prominent physicists for their department. Both J. J. Thomson and Rutherford were asked to join the staff in 1901, but neither would think of going to so isolated a place as New York City.

The sensational discoveries during the closing years of the Nineteenth Century energized the work in physics of all the great universities of America. Perhaps this was especially true of Chicago, where the great name of Michelson and the energy and enthusiasm of Millikan attracted many graduate students. The measurement of the electron charge by the oil-drop method and of Planck's constant by the photo-electric effect brought new precision at that time to those quantities. The graduates from Chicago were destined to fill very responsible positions in the universities and in the great industrial laboratories.

Then Washington University stepped into the limelight. A. H. Compton (1923), measuring the wave length of X-rays scattered by matter, found that the wave length was lengthened slightly and gave an explanation of the effect based on Planck's quantum theory. Both his experimental results and theoretical reasoning were disputed by others, but he proved his case conclusively.

The Compton Effect made it clear that bullets of light, particles of radiant energy, photons, possessed momentum and energy, that waves of light have the properties of particles. At once, by simple mechanics, we could derive the result that light would give momentum to atoms or would exert pressure on a surface on which it fell—a pressure equal to the energy density in front of the surface. This latter conclusion had been derived by Maxwell from his electromagnetic theory and had been discovered experimentally by Peter Lebedew in Moscow and with considerably greater precision by E. F. Nichols and G. F. Hull in the opening years of the century.

One of our great industrial laboratories stepped into the picture when Davisson and Germer (1927), of the Bell Telephone Laboratories, proved that an electron possesses wave-like characteristics. G. P. Thomson, in Aberdeen, arrived at the same result nearly simultaneously. These experiments supplemented Compton's work and proved that particles have the properties of waves. They also confirmed the theoretical work of Louis de Broglie.

All eyes turned toward India when Raman (1928) showed that light scattered by matter might differ in wave length from that of the original beam by amounts which could be explained by the quantum theory but which were completely unintelligible on the basis of the wave theory. India, which had had no place in physics at the beginning of the century, now had, and has continued to have, an honored place.

We come now to 1932, a wonder year in physics. Chadwick discovered the neutron; C. D. Anderson discovered the positron; Urey, Brickwedde, and Murphy discovered heavy water; Cockroft and Walton brought about the transmutation of lithium by firing into it hydrogen nuclei; the latitude effect in cosmic rays was discovered; Van de Graaff devised his generator for high voltages; and the young genius, E. O. Lawrence, with the help of his associates, brought to practical performance the little gadget upon which he had been working for some years—the cyclotron. That gadget has now grown to such dimensions that it may require an entire building to house it and three or four teams of specially trained physicists to operate it by remote control day and night. Compared with Cockroft and Walton's 150,000 volts, the cyclotron may give atom speeds of 60,000,000 volts. It is now installed in many of the great laboratories throughout the world. It may, with its housing, cost as much as $2,000,000.

It should be noted that of the seven discoveries above, two were produced in England and five in the United States. The two English contributions were of very great importance. We now know that neutrons have a large place in nature. In number or mass they are the chief constituents of all atomic nuclei. They are extremely effective bullets in breaking up atoms. They are the detonators in atomic bombs. But the cyclotron is also of importance. By means of it we have transmuted every known element into another.

Continuing the list of discoveries, we have that of artificial radioactivity by the Curie-Joliots in 1934, and of the mesotron in 1936 by Anderson and Neddemeyer, of California Institute of Technology, and by Street and Stevenson, of Harvard.

In 1934 Fermi and his numerous associates in Rome believed that by bombarding uranium by slow neutrons they had produced element 93. But they did not prove their case; indeed, there was great doubt about it. Hahn, Meitner, and Strassmann took up the problem and came to various conclusions, among them that transuranic elements as far out as 97 had been produced. In 1937 Irene Curie and Savitch thought that they had found lanthanum in the material but concluded that it must be a new transuranic element, 93, which had properties similar to lanthanum. (This would be reasonable, since the atomic number of lanthanum is 57. $57 + 36 = 93$.) Then, in January 1939, Hahn and Strassmann announced that analysis of the material obtained by bombardment showed that bar-

ium was present. *It was not there before the bombardment. It was not a transuranic element; it was barium.* Such a decision required the ultimate in courage. And if barium was present, so probably was krypton. That announcement produced an enormous upheaval in the domain of physics, for never before had a heavy atom been broken up into two atoms roughly equal in mass.

Aston, in his pioneer work with the mass spectrograph, had measured the masses of many atoms and had drawn a curve, called the packing fraction curve, showing the masses of the atoms. This was extended by Dempster so that competent physicists knew the masses of uranium, barium, and krypton; they knew the excess mass of the large atom over the sum of the two smaller masses; and by a simple mental operation they could compute the energy which would result. This computation was made almost immediately by Lise Meitner and Frisch. But early in 1940 A. O. Nier separated by the mass spectrograph U 234, U 235, and U 238. Dunning, Booth, and Grosse proved that it was U 235 that was broken up. Then the great reservoir of power of the physicists of America and England broke loose to bring about in five years a result, the achievement of which was not expected for 100,000,000 years—the production of the atomic bomb. Part of this story—a story that has no counterpart in all man's history—is told in the Smyth report.

There were some discoveries made during the war that call for inclusion. In 1939 in the Berkeley laboratory, Edwin McMillan tentatively identified elements 93 and 94 (of mass 239) in uranium bombarded by slow neutrons. In 1940 he and Abelson made the matter certain. The names proposed by McMillan were "neptunium" (Np) and "plutonium" (Pu). Later in that year uranium was bombarded by 30,000,000-volt deuterons from the cyclotron, and the 238 isotopes of these elements were obtained—indeed, enough of plutonium (0.5 mg., or one-millionth of a pound) to enable Seaborg, Kennedy, and Wahl to make a study of its chemical properties. Had plutonium not been discovered there still would have been no atomic bomb.

Continuing the list of discoveries we note that Seaborg has discovered by physical means elements 95 and 96, for which he has proposed the names "americum" and "curium." During the war eight chemical elements have been discovered by physical means: 43, 61, 85, 87, 93, 94, 95, and 96. Incidentally, all our handbooks of physics and chemistry and all our charts of chemical elements list elements 85 and 87 as alabamine and virginium. These names must be stricken out, since the magneto-optical method of identifying chemical elements, like the N-rays, is an exploded fallacy.

A cyclotron may produce more radioactive atoms and bring about more transmutations than would be produced by all the radium in the laboratories of the world. And in the very near future we may have uranium-plutonium piles or nuclear reactors which may provide neutrons and gamma rays of great intrinsic energy and of unparalleled intensity.

The betatron, a new device for producing high-energy particles—in this case, electrons—has been developed by Kerst. One such instrument in the General Electric Research Laboratory gives to electrons an energy of 150,000,000 volts. The resulting X-rays penetrate a foot of steel. They produce all manner of transmutations and generate mesotrons. Thus we may have man-made cosmic rays generated on the earth. However, both the cyclotron and betatron may be superseded by the synchrotron, which promises to give us energies of 300,000,000 volts. This idea, proposed in 1945 by McMillan in Berkeley, seems to have been proposed in 1944 by V. Veksler, of Moscow, who is building there a 30,000,000-volt instrument.

Let us look at the condition of physics today. In Germany, Japan, and parts of Russia science has been nearly destroyed, and in France and England it has been greatly curtailed; but in the United States physics has reached a pinnacle never before obtained. Note that during the first 20 years of the awards of Nobel Prizes only one American, A. A. Michelson, received the prize, and that was for work done 20 or more years earlier. Of those who received the awards in physics during the past 25 years, 12 are in America; and of the last nine medalists, eight are in America, four of these being native born. Half of our Nobel Prizemen in physics are recent arrivals from Europe, and there are other rather recent arrivals who are not inferior to some of the prizemen. All of these and our own talent have given to research and teaching an unchallenged prestige. Our young men no longer feel that it is necessary to go abroad for thorough training or for opportunities for research. Rather, before the war there was an increasing number of applicants from abroad for admission to our graduate schools. In fact, so great has been the number of applications of students from abroad that some of our universities have had to impose a quota system so that our native-born students would not be crowded out. Attention has already been called to the fact that Russia, Japan, and India were crowding toward the front in science. Now that Japan is badly crippled, the race may easily be won by Russia.

Of course, membership in our physical societies has increased. In 1899 there were only 30 or 40 members of the parent Society, whereas now there are 5,300, and in it and the related societies (optical, acoustical, X-rays, electron microscope, and physics teachers) a

total of 10,000, or about 300 times the original membership. Instead of the 20 or 30 papers a year there are now a few thousand.

There has been a corresponding increase in the research activities in our great universities and technical schools. It ought to be recorded that during these 50 years the number of students in our colleges and universities has increased by a factor of seven. Consider, for example, the M.I.T. (Every scientist in the world knows the meaning of those letters.) Originally it was purely an undergraduate technical institution. Now it is the foremost institute of technology in the world. Originally research in pure science was out of bounds. Gradually its field broadened. During the first 20 years of this century it gave a total of four Master's degrees and two Doctor's degrees in physics. Now it has 150 graduate students including those in three groups: the Research Laboratory in Electronics, the Laboratory of Nuclear Science, and the Acoustics Laboratory. During the war it cosponsored the Radiation Laboratory, which, next to the Manhattan Project, was the greatest enterprise of the war. Its operating expenses were about $3,000,000 a month. In that laboratory numerous radar devices were designed and brought to perfection. These included the H_2X air-borne set carried by heavy bombers so that targets could be found at night or through overcast; the Loran sets for long-range navigation, so that any vessel or airplane carrying a receiver could locate its position without chronometer or astronomical observation; and the powerful MEW (Microwave Early Warning) set which played so large a part in the invasion of Europe. Contracts placed with manufacturers by the Radiation Laboratory totaled about $2,000,000,000. Here we should note that the multicavity, multiresonant magnetron essential in very many of our radar devices is due to Oliphant, of Birmingham. The idea of the original magnetron is due to A. W. Hull, of the General Electric Research Laboratory.

Let us go across the continent to the Pacific Coast. In the University of California there are about 4,000 students in the undergraduate physics courses—3,000 different students. There were 120 graduate students when I last heard, and 100 were clamoring for admission. This does not include the famous Radiation Laboratory—the laboratory of the monster cyclotrons. At present I can get no information regarding that laboratory. It is under government control. Think of a laboratory with 200 graduate students in physics. Think of the apparatus required and of the guidance that is necessary. Then shed a tear for the physics instructors at Berkeley!

Let us consider the California Institute of Technology. It has risen from nearly nothing to be perhaps the foremost physics research laboratory in the world. It has 300 undergraduates in physics and 80 graduates. Fifty years ago these numbers were 12 and 0. In its physics faculty of 13 full professors there are two Nobel Prize winners, one-third of all the native-born American prize winners in physics. Its great growth and prestige is due, of course, to the abounding energy of R. A. Millikan, who has been its chief for 25 years.

In this brief survey I have named a few men and thereby may have offended many. I have not mentioned the contributions of Theodore Lyman and Bridgman; of Harrison and Slater; of Aston, Dempster, and Bainbridge; of Boltwood, Bumsted, and Swann; of C. T. R. Wilson, Dirac, Schroedinger, Heisenberg, and Bethe; of J. A. Wheeler; and of many others. But the workers in physics find joy in their work without the stimulus of publicity. They know well that "full many a flower is born to blush unseen" and are content.

The wonders of radar in all its forms, completely unknown 50 years ago, the discovery of the fission of uranium by Hahn and Strassmann, the production of the Atomic Bomb by the combined scientific power of the United States and England, by the Canadian contribution of the essential materials, and by the vast industrial power of the United States, have given to American physicists a prestige never before enjoyed. They are actually consulted by Congress regarding some matters. In fact, some of them are constantly shouting their advice from the housetops, but they can never expect to attain the prominence occupied by the rulers of the country, the so-called labor leaders, who, when the situation is right, make war on the rest of the Nation and who, at times of national emergency, hold up the Nation and demand its money or its life.

The scientists of this Nation are not likely to make war on this or any other nation. We are not combative or competitive. We should unite with the scientists of all other nations to outlaw war. No iron curtain should be allowed to enclose and segregate the scientists of any nation.

Science has come to have a prominent place in the life of our Nation, but the methods of science have not greatly changed. True, there is emphasis on teamwork in contrast with the efforts of an individual. Great laboratories supplied with very powerful and expensive apparatus can dwarf the work of ordinary college laboratories.

But what kind of people are you going to put into the large laboratories? What ideals are you going to place before them? Merely bringing a lot of men together in one building or center is not necessarily going to bring about progress in science. How did

it happen that Chadwick discovered the neutron? He knew from Compton's work what a photon would do if it struck an atom. He knew from long-established principles what an atom would do if it struck another atom. He could identify atoms by their ranges from the abundant data established by the long labors of Rutherford, Blackett, and himself. He possessed a great fund of knowledge and experimental skill, and he was a tremendous worker. Would he have been helped or hindered by a lot of clock punchers? I think it is of vast importance that we impress every teacher of physics in our colleges and universities with the view that progress in science depends on *his* knowledge of the domain in which he works, *his* scientific curiosity, *his* scientific imagination, *his* experimental skill and analytical ability, and that progress is likely to be accompanied by the scientific analogues of blood, sweat, and tears.

Technical Papers

The Similarity of the Effect of Podophyllin and Colchicine and Their Use in the Treatment of Condylomata Acuminata

MAJOR LESTER S. KING and
MAJOR MAURICE SULLIVAN[1]

Wm. Beaumont General Hospital, El Paso, Texas

The drug podophyllin, after having been dropped from the official list of cathartics in the *Pharmacopeia,* has become of renewed interest in dermatology. Kaplan (*1*) reported the use of podophyllin in oil as a topical application in the treatment of condylomata acuminata, with very satisfactory clinical results. Clinical trials have fully confirmed the efficacy of the drug. Its mode of action, however, has hitherto received no attention.

The application of podophyllin to normal human and rabbit skin reveals unusual changes affecting the epidermis. There is alteration of nuclear pattern, leading to the breakup of chromatin masses and the production of varying-sized pycnotic fragments. In other cells the disintegration of chromatin resembles markedly distorted mitotic figures, principally but not exclusively of the metaphase. There are corresponding cytoplasmic changes consisting, in different cells, of spongy swelling, shrinkage from the cell membrane, hydrops, delicate fibrillation, and alterations of standing reactions. We designate such altered cells as "podophyllin cells."

In many rabbits practically every cell in the epidermis discloses these severe nuclear and cytoplasmic alterations. The changes are transitory, and an essentially normal epidermis is re-established four to six days after a single application. Repeated applications show no increase in effect. On the contrary, a resistance seems to be established, and the histologic appearance following 20 applications is less striking than that following a single application. There is no evidence of cumulative effect in the experiments thus far undertaken.

Histologic examination of condylomata in the process of undergoing involution following applications of podophyllin shows numerous "podophyllin cells" of the type readily observed in the experimental material. In addition, there are widespread, nonspecific, degenerative changes in the epithelial cells.

The "podophyllin cells" were found to resemble the so-called "colchicine figures" described in the literature (*2, 3*). Consequently, suspensions of colchicine in oil were applied to condylomata acuminata, with clinical results superior to those of podophyllin. Similar colchicine suspensions applied to rabbit skin also resulted in pathologic alterations identical with the podophyllin effect, but more intense and of briefer duration.

Previously, in the experimental use of colchicine the drug has been injected parenterally, and its effect on various organs has been widespread. Its action has been considered to be to arrest mitosis in the metaphase. In the present work, colchicine and podophyllin, applied to the unbroken skin, do not suggest this mode of action. There is some direct, immediate, degenerative action, with resultant cell death. Other changes can be interpreted as a preliminary stimulation of mitosis, with marked distortion of the resulting pattern.

The differences between colchicine injected subcutaneously and colchicine applied locally can probably be attributed to the greater local concentration attainable with the latter method. It is of interest that podophyllin and colchicine are essentially without effect when applied to verrucae vulgares or other

[1] Present addresses, respectively: 836 Wellington Avenue, Chicago 14, Illinois, and 3301 North Charles, Baltimore 18, Maryland.

lesions with extensive keratinization. This suggests that the penetrating power of the drugs is slight.

It is known that totally unrelated compounds have actions similar to colchicine. Ludford (*3*) mentions auramine, urethane, and sodium cacodylate as producing the same effects as colchicine on injection. Podophyllin, by local application, is now shown to have the same results as colchicine.

Detailed descriptions of our clinical and pathological studies will be reported.

References

1. KAPLAN, I. W. *New Orleans med. surg. J.*, 1942, **94**, 338.
2. LITS, F. J. *Arch. int. Méd. Exp.*, 1936, **11**, 811.
3. LUDFORD, R. J. *Arch. Zellforsch.*, 1936, **18**, 411.

X-Ray-induced Depolymerization of Thymonucleohistone and of Sodium Thymonucleate[1]

A. H. SPARROW and FLORENCE M. ROSENFELD
Biological Laboratories, Harvard University

It is well known that X-rays greatly increase mutation rates and produce chromosome breaks and aberrations, but the mechanism by which these effects are brought about is not well understood. It is assumed that excitations or ionizations produced by the X-ray quanta cause molecular disturbances or rearrangements which ultimately lead to visible chromonemal breaks or gene mutations (*2, 5*). Practically nothing is known about the very complex chain of events connecting the initial activation with the end result. It appeared that an investigation of the effects of X-rays on isolated chromosomal constituents might yield pertinent information. A study was therefore begun of the effects of X-rays on the physical properties of two important nuclear components: thymonucleohistone and the sodium salt of thymonucleic acid.

The nucleohistone used was prepared from calf thymus by the method of Mirsky and Pollister (*4*). Sodium thymonucleate was separated from the nucleohistone by saturation with sodium chloride as described by Bang (*1*) and Hammarsten (*3*). Both substances have characteristically high relative viscosities and show intense birefringence of flow. These properties serve as indexes of molecular asymmetry.

Solutions of 0.2 per cent sodium thymonucleate in water and 0.4 per cent thymonucleohistone in 1 M NaCl were irradiated. Viscosities were measured in the Ostwald type of capillary viscometer immersed in a water bath at 30 ± .05° C. Viscosities relative to the solvent for control (unrayed) samples and for rayed samples up to dosages of 120,000 r are given in Table 1. The data are presented graphically in Fig. 1.

TABLE 1
RELATIONSHIP OF X-RAY DOSAGE TO RELATIVE VISCOSITIES OF SOLUTIONS OF THYMONUCLEOHISTONE AND SODIUM THYMONUCLEATE

Dosage (r)	Relative viscosity	
	Nucleohistone	Sodium thymonucleate
0	3.47	3.97
7,500	3.27	3.50
15,000	3.10	3.13
30,000	2.72	2.26
45,000	2.54	1.99
60,000	2.21	1.61
90,000	1.79	1.25
120,000	1.74	1.15

Plotted on a semilogarithmic scale, these values give approximately straight-line curves for both nucleate and nucleohistone. However, the considerable differences in slope indicate that equal dosages cause a greater drop in viscosity of the nucleate than of the thymonucleohistone solution.

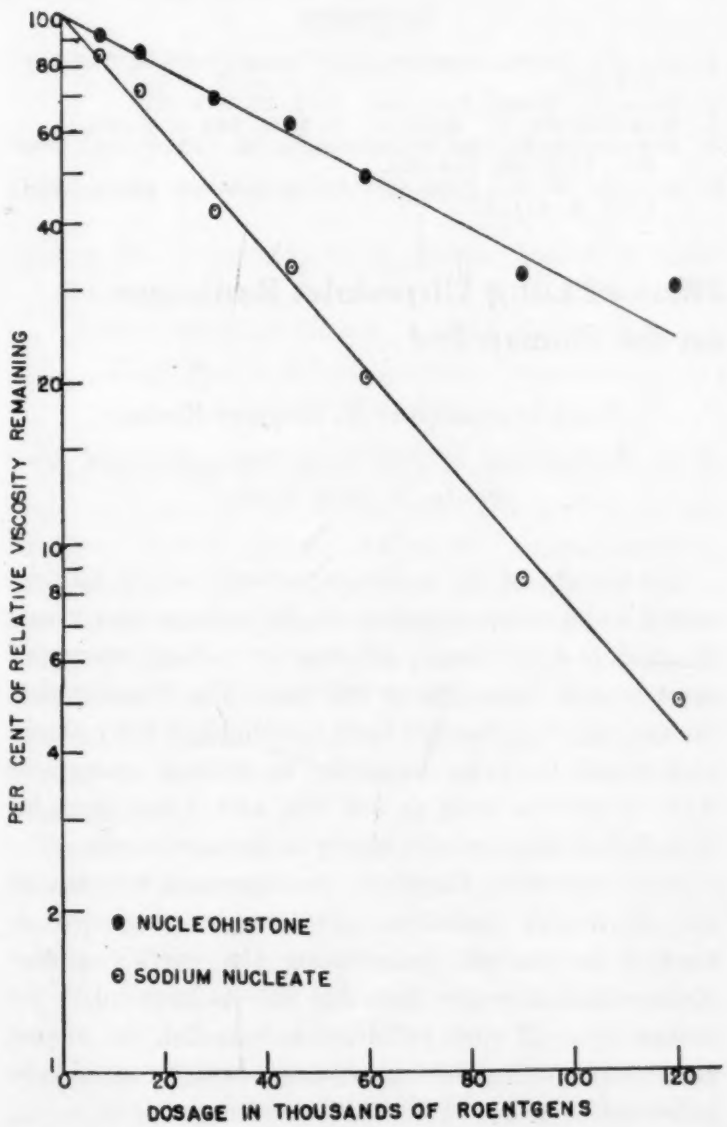


FIG. 1. Effect of X-ray dosage on relative viscosities of solutions of thymonucleohistone and sodium thymonucleate.

Streaming birefringence was present in both nucleate and nucleohistone solutions before raying. After

[1] This investigation was supported in part by a grant from the International Cancer Research Foundation.

120,000 r both solutions showed considerably less birefringence, and again the loss was much greater for the nucleate than for the nucleohistone.

Since the magnitude of relative viscosity and the intensity of flow birefringence are both indicative of the degree of molecular asymmetry, the above changes in these properties probably represent a degradation or partial depolymerization of high molecular weight particles initially present into shorter, more symmetrical chains or segments. Experiments are under way to determine the nature and extent of the breakdown and the size and weight of the degraded particles.

Similar X-ray-induced changes in the molecular configurations of the nucleic acid components of living cells can be expected. Such changes may very probably (1) represent the initial step in the production of gene mutations and chromosomal breaks and (2) be instrumental in causing a breakdown of the normal nucleic acid metabolism of the cell.

References

1. BANG, I. *Beitr. chem. Physiol. Pathol.*, 1904, **4**, 115–138; 362–377.
2. FANO, U. *Quart. Rev. Biol.*, 1942, **17**, 244–252.
3. HAMMARSTEN, E. *Biochem. Z.*, 1924, **144**, 383–465.
4. MIRSKY, A. E., and POLLISTER, A. W. *Proc. nat. Acad. Sci.*, 1942, **28**, 344–352.
5. MULLER, H. J. *Cold Spr. Harb. Sympos. quant. Biol.*, 1941, **9**, 151–167.

Effect of Long Ultraviolet Radiation on the Human Eye

ELEK LUDVIGH and V. EVERETT KINSEY

Howe Laboratory of Ophthalmology, Harvard University Medical School

The results of an investigation (*2*) which has received widespread attention (*1, 3*) indicate that visual function is deleteriously affected by radiant energy of wave lengths from 300 to 365 mμ. The investigation showed that the absolute light threshold of baby chicks was raised by prior exposure to radiant energy of wave lengths as long as 360 mμ, and it has been inferred that these results apply to human beings.

It is important, therefore, to determine whether or not ultraviolet radiation of wave lengths such as abound in sunlight penetrating the earth's atmosphere—that is, longer than 320 mμ—is harmful to the human eye. If such radiation is harmful, the almost universal wearing of sunglasses outdoors would be indicated.

The radiations from a 1,000-watt mercury arc operating at about 30 atmospheres pressure were filtered so as to remove most of the visible and almost all of the ultraviolet radiation shorter than 320 mμ. The transmission characteristics of the filter combination as determined by measurements with a Beckman spectrophotometer are shown in Fig. 1. Seven individuals, ranging in age from 22 to 38 years, fixated this filtered source at a distance of 30 cm. for five minutes with the left eye while the right was covered. The foveal light-difference sensitivity and critical flicker frequency of both eyes of these individuals had been previously determined. The testing methods employed were sufficiently sensitive to detect characteristic individual differences.

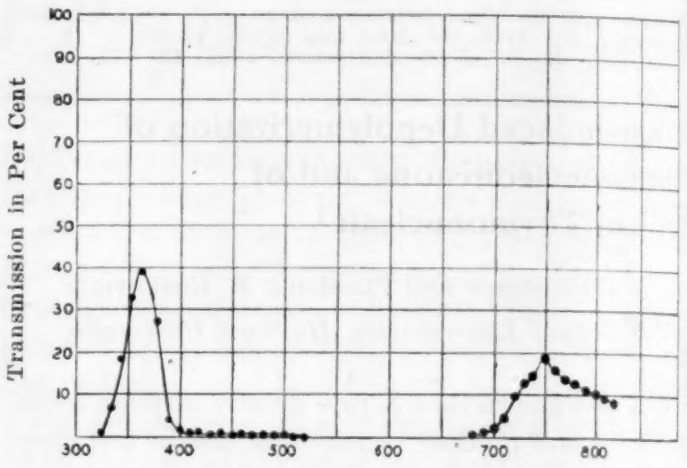


FIG. 1

The observers were tested five minutes and one hour after exposure to the arc. There was no statistically significant difference in the results between the two eyes of six observers or between the measurements of any one eye before and after irradiation. The seventh observer showed a higher light-difference sensitivity threshold in the left eye (exposed) both before and after irradiation. In this individual the irradiation produced a statistically nonsignificant improvement in the light-difference sensitivity of the left eye.

The ultraviolet energy above 320 mμ which was concentrated on the fovea in these experiments was greatly in excess of what could ordinarily be obtained in nature except, for example, by fixation of the sun, in which case eclipse blindness would result from absorption of visible and infrared radiation by the pigment epithelium.

The discrepancy between the results of the previously reported experiments on chicks and ours on human beings might be considered to be attributable, among other factors, to the use of the opticokinetic response in the dark-adapted eye as a test on chicks and the light-difference threshold on human beings. In civilian life it may be doubted whether the average individual ever reaches a comparable state of dark adaptation except possibly when asleep. The most likely cause for the discrepancy between results is, however, the marked difference in absorption and gen-

eral physiological characteristics between the eyes of baby chicks and those of adult human beings.

It is concluded that ultraviolet radiations longer than 320 mμ encountered in nature are without deleterious effect on these two important functions of the normal eye.

References

1. Stafford, J. *Science*, 1945, **102**, 14 (Suppl.).
2. Wolf, E. *Proc. nat. Acad. Sci.*, 1945, **31**, 236.
3. ———. *Life*, 1946, **20**, 3, 115.

Maintenance of Respiratory Activity in Stored Peripheral Nerve

Joseph Wortis and Rema Lapouse

Department of Psychiatry, New York University Medical College, and *Psychiatric Division, Bellevue Hospital, New York City*

Two-centimeter sections of the proximal portion of the sciatic nerve of the adult white rat were used in these experiments. Respiratory activity was measured in a Warburg-Barcroft apparatus, using a Krebs-Ringer suspension medium buffered at pH 3.38. In most experiments the suspension fluids contained 0.2 per cent glucose; in a few, 0.2 per cent sodium lactate was used; and in a few, plain solution was employed. Preserved specimens were kept aseptically in cotton-stoppered Erlenmeyer flasks in plain Krebs-Ringer solution at 5.5° C. Each experiment involved duplicate specimens run simultaneously; calculations were based on wet weight. In a series of preliminary runs simultaneous determinations of oxygen uptake of minced rat brain were used as checks in addition to the three thermobarometers used as controls. Altogether, 44 determinations were made.

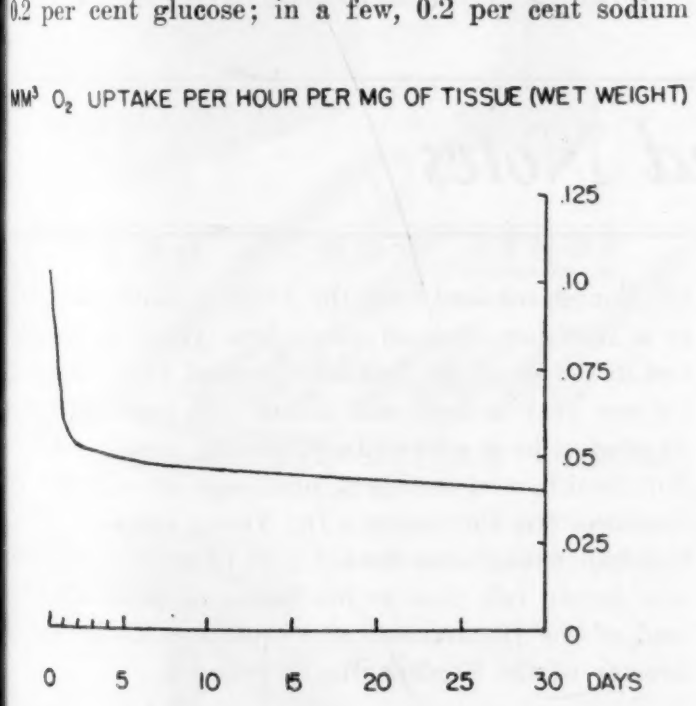


Fig. 1. Oxygen uptake of rat peripheral nerve preserved for various periods of time as described in text.

The results with the use of 0.2 per cent glucose medium are plotted in Fig. 1. All significant points on the curve represent an average of at least three experiments. Similar results were obtained in a lactate or plain medium, although these experiments were not continued beyond seven days. The oxygen uptake of fresh adult rat sciatic nerve in a glucose medium was 0.104 mm.^{3} O_2/hour/mg. of tissue, wet weight, or approximately one-tenth that of whole minced brain. After preservation for 2 days this value dropped to 0.055; after 30 days, to 0.044. The actual decline in oxidative activity is probably less than that indicated by the curve inasmuch as the wet weight of the nerve increases by at least 20 per cent after immersion in a protein-free solution of the Krebs-Ringer type (*1*). A correction for this factor still needs to be made and will demonstrate an even better preservation of oxidative activity than is indicated by the curve.

Reference

1. Shaffer, M., Chang, T. H., and Gerard, R. W. *Amer. J. Physiol.*, 1935, **3**, 697–710.

A High Rate of Natural Plasmodium Infection in *Anopheles crucians* [1]

Curtis W. Sabrosky, *U. S. Public Health Service, Manning, South Carolina*; G. E. McDaniel, *State Board of Health*; and R. F. Reider, *U. S. Public Health Service, Columbia, South Carolina*

The principal vector of human malaria in eastern and southeastern United States is accepted to be the common and abundant *Anopheles quadrimaculatus* Say, and research and control programs for years have been based upon this hypothesis. For various reasons, such as differences in feeding habits or abundance, or failure to demonstrate infection in nature, the other species of Anopheles are not regarded as important factors in the transmission of Plasmodium.

During the summer of 1945, an extensive anopheline dissection program was carried out in an endemic malaria area along the Santee Swamp in coastal plain South Carolina. *A. quadrimaculatus* showed a gland infection rate of .175 per cent (33 infected mosquitoes in 18,826 dissected). By early November that species had disappeared from the usual resting places, although a number of *crucians* (=*crucians crucians*)

[1] The work upon which this note is based is part of a comprehensive Field Research Study of Malaria being conducted jointly by the South Carolina State Board of Health and the U. S. Public Health Service, Office of Malaria Control in War Areas. Detailed papers on various phases of the program are in preparation.

were still present, up to 90 per natural resting place. Between 5 and 28 November 701 *crucians* were dissected, and 23, or 3.28 per cent, were found to have sporozoites in the salivary glands. During the immediately preceding months, when these infections originated, the monthly prevalence of human malaria in the same area, as determined by household thick film blood smear surveys in the first two weeks of each month, varied from 7 to 10 per cent (9.3 per cent in September, 7.4 per cent in October, 9.6 per cent in November).

The intensity of infection was higher in the infected *crucians* than in the *quadrimaculatus*. Under a scale of 1, 2, 3, and 4 plus used in malaria investigations of the National Institute of Health, 26.1 per cent of the *crucians* were heavily infected (3 and 4 plus) and 73.9 per cent lightly infected, whereas these proportions were, respectively, 18.2 and 81.8 per cent for *quadrimaculatus*. Those lightly infected averaged 15 sporozoites per mosquito for *crucians* and 3.2 for *quadrimaculatus*.

When captured, 60.3 per cent of the *crucians* were freshly engorged, and another 32.3 per cent contained blood only partly digested, indicating very recent meals and considerable activity throughout November. The mean daily temperatures during the month ranged from 43° F. to 72° F., and the minimum temperatures from 24° F. to 62° F. Precipitin tests on 226 of the engorged adults, carried out at the Carter Memorial Laboratory, Savannah, Georgia, showed that 47.3 per cent had fed on equine blood, 23 per cent on bovine, 7.5 per cent on porcine, and 22.1 per cent on a blood source other than the above (no reaction) but that none had fed on human or avian blood.

In *A. crucians,* which is widespread in the southern states but abundant primarily on the coastal plain, only three naturally infected specimens appear to have been reported in the literature (*1*). For this reason, and because no epidemiological evidence to the contrary has been forthcoming, the species has been considered unimportant as a malaria vector. However, the present finding of a high infection rate in *crucians,* in addition to the fact that the species is more active and relatively more abundant earlier and later in the season than the principal vector in the United States, *quadrimaculatus,* indicates that the role of *crucians* in malaria transmission will bear further investigation.

Reference

1. MAYNE, BRUCE. *Publ. Hlth Rep. Wash.*, 1919, **34**, 1355; METZ, C. W. *Publ. Hlth Rep. Wash.*, 1919, **34**, 1357.

News and Notes

Special Announcement

All of the Washington offices of the AAAS were consolidated at the new Association building, 1515 Massachusetts Avenue, N.W., Washington 5, D. C., on 9 September 1946. The new building houses the offices of the administrative secretary, the editors and staffs of *Science* and the *Scientific Monthly,* the advertising department, and the membership and accounting departments. All communications relative to membership, publications, and advertising should now be sent to the new address.

About People

R. Hugh Wood, physician-in-chief at the Emory University Hospital, has been named dean of the Emory University School of Medicine. He succeeds Eugene A. Stead, Jr., who recently resigned to accept a position at Duke University.

Richard H. Young, Northwestern University, was appointed dean of the University of Utah Medical School at the August meeting of the Board of Regents. Dr. Young, released from the Army in November 1945 as a lieutenant colonel after four years of service, was in charge of the Twelfth Hospital Unit, stationed for one year in Iran and almost two years in Italy. At present he is university physician, director of student health, and assistant professor of medicine at Northwestern University. Dr. Young succeeds H. L. Marshall, acting dean for the past 18 months, who will now devote full time to his duties as professor and head of the Department of Preventive Medicine and director of the Student Health Service.

Helmut Gordon, Department of Physiology, Medical School, Budapest, has joined the staff of the Laboratories of Bacteriology, University of Notre Dame, as pathologist.

William F. Allen, for 30 years head of the Department of Anatomy, University of Oregon Medical School, was recently made emeritus professor. He is succeeded by Olof Larsell.

Ward V. Evans, emeritus professor of chemistry, Northwestern University, will receive the 1946 Honor-

ary Scroll Award of the American Institute of Chemists at a dinner meeting of the Chicago chapter on 4 October. Prof. Evans is being honored for his outstanding achievements in the field of chemistry as a great teacher, as an industrial consultant, and for his high civic spirit.

Arthur H. Spillers has been named chief of the Division of Private Forestry in the Washington office of the Forest Service, U. S. Department of Agriculture. He was released from the Army last January.

Joseph Ewan, formerly assistant curator, Division of Plants, U. S. National Museum, has joined the Division of Plant Exploration and Introduction of the Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, Beltsville, Maryland, as associate botanist and acting curator of the Herbarium of National Arboretum.

Ralston Russell, Jr., director of ceramic research, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania, will join the Ohio State University staff on 1 October as professor of ceramic engineering. He succeeds Arthur S. Watts, chairman of the Department for 30 years, who will continue to do research and engineering work. John L. Carruthers has been appointed chairman of the Department.

Ernest B. Forbes, for the past 24 years director of the Institute of Animal Nutrition, Pennsylvania State College, retired on 1 July at the age of 70. Raymond W. Swift has been elected acting director.

A. G. Norman, since 1937 professor of soils at the Iowa State College and research professor in the Iowa Agricultural Experiment Station in charge of teaching and research in soil microbiology, has been appointed to a position under the War Department. Dr. Norman will be stationed at Camp Detrick, Frederick, Maryland.

N. T. Mattox, associate professor of zoology, Miami University, Oxford, Ohio, has been appointed visiting professor of zoology, University of Puerto Rico, Mayaguez, for the coming academic year. He has been granted a year's leave of absence from Miami University.

Raymond S. Edmundson, Virginia Geological Survey, has been appointed assistant professor of geology, School of Geology, University of Virginia, to teach physical geology and stratigraphy.

Laurence Irving and *P. F. Scholander* are making a trip to Norway, Denmark, and Sweden to observe the methods and organization used by Scandinavian biologists in field studies on expeditions. The Arctic studies and publications from the Scandinavian countries are regarded as models by American scientists interested in the Arctic.

Announcements

Six internationally known psychologists received Doctor of Science degrees from the University of Pennsylvania on 5 September at a convocation celebrating the 50th anniversary of the founding of its Psychological Clinic, the first in the world. Among those honored were four former presidents of the American Psychological Association, which held its 54th annual meeting at the University of Pennsylvania on 3–7 September. These were: John Dewey, emeritus professor of philosophy, Columbia University, and the only surviving original member of the Association; Edwin G. Boring, professor of psychology and director of the Psychological Laboratory, Harvard University; Robert S. Woodworth, emeritus professor of psychology, Columbia University; and Lewis M. Terman, emeritus professor and former executive head of the Department of Psychology, Stanford University. The two other recipients of the degrees were: Wolfgang Köhler, professor of psychology, Swarthmore College, and former director of the Psychological Institute, University of Berlin, and Henry H. Goddard, emeritus professor of abnormal and clinical psychology, The Ohio State University. The address at the convocation was delivered by Robert A. Brotemarkle, professor of psychology and director of the Psychological Laboratory and Clinic at the University.

The Psychological Clinic was founded by Lightner Witmer, now emeritus professor of psychology at the University, who studied at Pennsylvania and at the University of Leipzig and became director of the Laboratory of Psychology at Pennsylvania in 1892. The Clinic began in March 1896, when the Laboratory of Psychology undertook the study and remedial treatment of mentally and morally retarded children suffering from physical defects which resulted in slow development and prevented progress in school. During the academic year 1896–97, cases were seen in the Clinic for a few hours only, one day each week. In the summer of 1897 a daily clinic was inaugurated at which about three cases were seen every day. In 1907 there was a significant development when Dr. Witmer established the journal called *The Psychological Clinic* and publicly gave his new work the name "clinical psychology." In 1909 the University of Pennsylvania further recognized the importance of the Psychological Clinic by making it a distinct administrative unit with a director responsible to the trustees of the University. More adequate quarters for the clinic were provided, and the annual budget for its maintenance was increased at this time.

Besides the handling of mentally deficient and educationally retarded cases with which the Clinic began its work, and which still continues to be one of its primary functions, there have been developed a number of clinics for the handling of special types of cases. The first of these special clinics was that for the diagnosis and correction of speech defects, instituted in 1914, which was developed by the late Edwin B. Twitmyer. In 1920 a special clinic for vocational and industrial guidance was inaugurated under the direction of Morris S. Viteles. Several years later the clinical examination of students at the college-adult level was developed by Prof. Brotemarkle.

As a result of the continuous development of the Psychological Clinic it now handles nearly 1,000 new cases a year, and its files, containing over 20,000 case records, are invaluable sources of material for psychological research.

A program for training critically needed clinical psychologists was discussed at a recent meeting between Veterans Administration officials and representatives of 18 universities. According to officials, the Veterans Administration hospitals and mental hygiene clinics could use all the trained clinical psychologists in the Nation.

The university representatives endorsed the Veterans Administration requirement that key clinical psychologists should have a Ph.D. degree in psychology and also recommended that Public Law 293, 79th Congress, which set up a Department of Medicine and Surgery within the Veterans Administration, be amended to include clinical psychologists in the same legal and professional status as doctors, dentists, and nurses. The representatives also suggested that the Veterans Administration offer positions for internes and residents in clinical psychology. Residencies in medicine are now being offered in more than a third of the Administration's hospitals and, while internships are permitted, they have not yet been offered to doctors.

The group worked out minimum requirements and standards which will be used in training the initial 200 students in clinical psychology. Applications should be made to the following cooperating universities, all of which have been approved for graduate work by the American Psychological Association: California (Berkeley and Los Angeles), Chicago, Illinois, Kansas, Kentucky, Michigan, Minnesota, Pennsylvania, Pittsburgh, Rochester, Columbia, State University of Iowa, Ohio State, New York, Southern California, Stanford, and Yale. Northwestern University and Pennsylvania State College, although approved schools, did not send delegates because it is unlikely that they will be able to accept any trainees under this program. Selections of candidates will be made by the universities, subject to approval of the Veterans Administration; veterans will be given preference.

The Worcester Foundation for Experimental Biology and *Tufts College* have completed arrangements for affiliating the Foundation with the Physiology Department of Tufts Medical School, headed by David Rapport. Hudson Hoagland and Gregory Pincus, codirectors of the Foundation, have been appointed research professors of physiology at the Medical School. Robert P. Jacobson, Nicholas T. Werthessen, Norman W. Pirie, Min-Chueh Chang, Zareh Hadidian, Oscar M. Hechter, Sidney Roberts, and Clara M. Szego have been appointed research associates in physiology. Plans have been made to implement the association and to make possible the training of candidates for the Ph.D. degree in the medical sciences in the laboratories of both institutions.

The Division of Natural Sciences, Rockefeller Foundation, has announced the following additions to its staff: A. R. Mann, since 1937 vice-president and director of the General Education Board, has been given a part-time appointment as deputy director for agriculture and will have charge of the Division's agricultural activities, particularly its program in Mexico. H. Marshall Chadwell, formerly professor and chairman of the Department of Chemistry and Chemical Engineering, Tufts College, has been made associate director and will be primarily concerned with assisting the director with the Foundation's activities in the United States. Gerald Roland Pomerat, formerly in the Department of Biology, Harvard University, has been appointed assistant director and will spend a considerable portion of his time in Europe. Harry M. Miller, Jr., who is responsible for the Division's work in Central and South America, has recently been promoted to an associate directorship.

A Field Conference of Pennsylvania Geologists was held at State College and Altoona from 30 May to 2 June. This meeting was the 12th annual Conference and was held under the joint auspices of the School of Mineral Industries, Pennsylvania State College, and the Pennsylvania Topographic and Geologic Survey, Department of Internal Affairs. The committee in charge of the affair consisted of: Frank M. Swartz (chairman); Paul D. Krynine, School of Mineral Industries; G. M. Kay, Department of Geology, Columbia University; and R. M. Foose and M. N. Shaffner, the Pennsylvania Survey. About 80 geologists from colleges, universities, state surveys, and industries in Pennsylvania, New Jersey, New York, Virginia, and West Virginia attended. At the annual

banquet, A. W. Gauger, School of Mineral Industries, acted as toastmaster, and Edward Steidle, dean, School of Mineral Industries, spoke about educational problems of the college; George H. Ashley, state geologist, spoke about the Pennsylvania Survey's publications and progress, and Frank M. Swartz gave an outline of the geologic excursions that were to be taken in the remaining days of the Conference.

The Sandoz Chemical Works has made a grant of $1,000 a year to F. R. Goetzl, Permanente Foundation, Oakland, California, for studies on blood coagulation.

Meetings

The 274th meeting of the American Physical Society, to be held in New York City on 19–21 September, will feature three principal topics, one meeting day devoted to each. The program and respective chairmen follow:

Thursday—"Cosmic-Ray and Subnucleonic Physics": E. U. Condon (morning meeting); L. A. DuBridge (afternoon meeting); and P. M. S. Blackett (discussion). (An additional meeting on this subject will be held on Saturday morning, Dr. DuBridge presiding.) *Friday*—"Theories of the Elementary Particles": G. G. Hyde (morning meeting); K. K. Darrow (afternoon meeting); and J. R. Oppenheimer (discussion); *Saturday*—"Accelerators": L. W. Alvarez (morning meeting); E. U. Condon (afternoon meeting); and C. G. Suits (discussion).

Niels Bohr will give the Friday dinner address on "The Tradition of Science."

The International Technical Congress will be held at the Maison de la Chimie in Paris, France, on 16–21 September. Problems of reconstruction, nuclear energy, and engineering trends and organization in the United States will be discussed by the American delegation of engineers, scientists, and economists. Harry A. Winne, vice-president of the General Electric Company, will speak on nuclear energy, as one of the features of the American program.

The American committee for the Congress includes representatives of the five national engineering societies: Clarence E. Davies, American Society of Mechanical Engineers, chairman; W. N. Carey, American Society of Civil Engineers; A. B. Parsons, American Institute of Mining and Metallurgical Engineers; H. H. Henline, American Institute of Electrical Engineers; and S. L. Tyler, American Institute of Chemical Engineers.

Elections

The Pasteur Society of Central California held its first postwar meeting and banquet on the evening of 20 June at the Shattuck Hotel, Berkeley. Officers elected for 1946–47 are: William Hinshaw, associate professor of veterinary science, University of California, president; Lowell Rantz, assistant professor of medicine, Stanford University Medical School, vice-president; Sanford Elberg, assistant professor of bacteriology, University of California, secretary-treasurer; William Hammon, dean of the School of Public Health, University of California, and Stewart Madin, associate, Division of Veterinary Medicine, University of California, councilors.

The Chicago Academy of Sciences elected the following officers at its 89th annual meeting: Nathan Smith Davis, president; James P. Simonds, first vice-president; Kenneth A. Reid, second vice-president; Nat T. Burfeind, secretary; Henry B. Babson, trustee for five years; and Alfred Emerson and C. L. Turner, scientific governors for three years.

The American Leather Chemists Association held its 43rd annual meeting on 19–21 June at Lake George, New York. The following officers were elected: T. F. Oberlander, president; A. H. Winheim, president-elect; and Fred O'Flaherty, secretary-treasurer.

Albert F. Blakeslee has been elected an associate in the Section of Natural Sciences of the Royal Academy of Belgium.

Adolph H. Schultz, associate professor of physical anthropology, Johns Hopkins Medical School, has been elected a corresponding member of the Société d'Anthropologie de Paris.

Curt Stern, University of Rochester, has been elected as the next managing editor of *Genetics,* according to an announcement made by the Editorial Board. He succeeds M. M. Rhoades, Columbia University, who will complete a six-year term on 1 January 1947.

C. M. Louttit has been elected editor of *Psychological Abstracts* succeeding Walter S. Hunter, of Brown, who was largely responsible for founding the journal and has been its editor for twenty years.

Recent Deaths

Gerald V. R. Hoogendyk, 61, formerly on the faculties of the Universities of Colorado and Illinois and Bryn Mawr and Sweet Briar Colleges, died at Alhambra, California, on 22 August.

Karl Friedrich Stahl, 91, emeritus chairman of the Pittsburgh Section, American Chemical Society, died in Pittsburgh on 26 August as a result of injuries received when hit by a truck near his home.

In the Laboratory

Saccharose-fermenting Diphtheria Bacilli

EVELYN A. MAUSS and MARGARET J. KEOWN
Division of Laboratories, State Board of Health
Rapid City, South Dakota

In the routine laboratory examination of throat cultures for *Corynebacterium diphtheriae,* it has been customary (*2*) to discard as diphtheroids those organisms which ferment both dextrose and saccharose. Possible error due to this practice has more recently been pointed out (*1, 3*).

It is to be noted that each of the strains was recovered from a case of diphtheria, from a contact of a case, or from a convalescent contact who was suspected of having had the disease before being seen by the physician. It is probable that, had not the specimens come from sources which might have been expected to yield positive cultures, they would have been discarded after saccharose fermentation had been demonstrated. As a result of these few experiences we now routinely check for virulence all corynebacteria which show typical morphology on Loeffler slants, typical colony formation on chocolate tellurite agar plates, and dextrose fermentation with or without saccharose fermentation. This would be an advisable procedure for other public health laboratories to adopt until the prevalence of the saccharose-fermenting strains has been determined.

TABLE 1

SOME CHARACTERISTICS OF 8 STRAINS OF SACCHAROSE-FERMENTING DIPHTHERIA BACILLI

Strain No.	Acid formation from*				H†	Virulence test in		Colony type‡	P§	Final pH in broth	Clinical Notes
	D	S	St	Glyc		rabbits	chicks				
8–16	+	+	–	–	–	+	+	Smooth	–	8.0	When first seen, patient had sore throat and remnants of membrane.
8–1	+	+	+	–	–	+	+	Smooth	–	7.6	Patient severely ill; had typical membrane; good response to antitoxin.
7–9	+	+	–	–	+	+	+	Almost smooth	–	7.2	Patient severely ill; had typical membrane; good response to antitoxin.
14–1	+	+				+					Contact of case; had sore throat before seen by physician.
8–10	+	var.	+	–	–	+	+	Smooth	–	7.4	Contact of case; had severe sore throat before seen by physician.
17–4	+	var.	+	+		+	+				Severe case; typical membrane first noted on tonsillar region on one side, then on other side, finally spreading toward uvula; good response to antitoxin.
11–5	+	var.	+	+	–	+	+	Almost smooth	+	7.8	Severe sore throat regarded by one physician as typical clinical diphtheria and by another as not typical; good response to antitoxin.
12–1	+	var.	+	+	–	+	+	Almost smooth	–	7.7	Mild case; typical membrane; good response to antitoxin.

* D = dextrose; S = saccharose; St = starch; Glyc = glycogen.
† H = hemolysin production.
‡ On chocolate tellurite agar plate after 48-hour incubation at 37° C.
§ P = pellicle formation.

Several throat cultures received by this laboratory in the past two years have yielded organisms which were typical and virulent *C. diphtheriae* except that they more or less consistently produced acid from saccharose. The fermentative properties of these organisms were checked in this laboratory and in two others. Data on the strains isolated appear in Table 1.

References

1. Frobisher, Martin, Jr., Adams, Martha L., and Kuhns, William J. *Proc. Soc. exp. Biol. Med.*, 1945, **58**, 330–334.
2. ———. *Diagnostic procedure and reagents.* New York: American Public Health Association, 1941.
3. ———. *Diagnostic procedure and reagents.* New York: American Public Health Association, 1945.

A Method for Immunological and Chemical Investigations of Body Fluids by Means of Purified Gelatin

Oscar Kanner

Pathology Department, St. Francis Hospital, La Crosse, Wisconsin

Gelatin sheets of good quality are placed for 24 hours or longer in running water and then for three changes (several hours each) in distilled water; the sheets are then dried by means of a stream of air and stored, protected from moisture and dust.

Strips of purified gelatin are placed into serum and allowed to swell until the liquid outside the gelatin has been reduced to some desired volume. The serum is analyzed for certain constituents before and after the addition of the strips. These constituents may be divided into two classes: those which penetrate the swelling gelatin, such as water and other small molecules, and those which are incapable of entering, such as proteins and lipids. The concentration of the second class increases in proportion, with the fraction of water which serves to swell the gelatin. Thus, the class to which a certain constituent belongs may be determined by analysis of the serum before and after the swelling.

Results

Experiments were made with respect to the behavior of chlorides, calcium, icterus index, cholesterol, protein, and certain antibodies, as well as syphilis "reagin," with the following results:

Chlorides—Nearly unchanged but found slightly lower in the concentrate. (Original, 0.58 per cent; after gelatin treatment, 0.56 per cent. Original, 0.52 per cent; concentrate, 0.49 per cent. Method: Shales and Shales.)

Protein—Concentration increased after gelatin treatment. (Original, 5.0 per cent; after gelatin treatment (volume reduced $2\frac{1}{2}\times$), 11.0 per cent. Original, 6.0 per cent; concentrate, 13.1 per cent.[1] Method: Greenberg.)

Icterus index—Increases with gelatin procedure. (Original, 11.8; $2\frac{1}{2}\times$ concentrate, 23.0.)

[1] The increase in protein concentration would explain the slight reduction in chlorides because of adsorption at the occasion of protein precipitation in the chloride method. The Greenberg method may determine to a minor degree other substances than proteins, in particular those which smaller molecules may diffuse into gelatin.

Cholesterol—Increases with procedure. (Original, 0.19 per cent; $2\frac{1}{2}\times$ concentrate, 0.42 per cent. Original, 0.16 per cent; concentrate, 0.33 per cent. Method: Bloor.)

Calcium—Increases like nondiffusible substances. In this respect the procedure is different from ultrafiltration, where only a fraction is found to be nondiffusible. (Original, 10.0 mg. per cent; $2\frac{1}{2}\times$ concentrate, 24.2 mg. per cent. Original, 10.2 mg. per cent; concentrate (about $3\times$), 27.0 mg. per cent. Method: Kramer-Tisdal.)

Agglutinin against typhoid bacilli—Rabbit serum. (Original, titer 1:1,400; 1:1,600 and higher, negative. $2\frac{1}{2}\times$ concentrate, titer increased to 1:3,000; 1:4,000 and higher, negative.)

Isoagglutinin—B serum against A cells. (Original, titer 1:10; 1:15 and higher, negative. $3\times$ concentrate, titer 1:25; 1:30 and higher, negative.)

Anti-Rh serum, monkey. (Original, titer 1:30; 1:40, negative. $3\times$ concentrate, titer 1:80; 1:100, negative.)

Quantitative Kahn test—(Original, 40 Kahn units; $3\frac{1}{2}\times$ concentrate, 120 units. Original, 60 Kahn units; concentrate (about $2\frac{1}{2}\times$), 160 Kahn units.) The reagin appears to be nondiffusible.

Vernes test—Behavior quite different from Kahn test; reagin appears to be diffusible. (Originals and concentrates, respectively, as follows: 119, 120; 52, 51; 10, 10; 42, 40; 14, 17; 28, 29; 28, 25; 15, 13; 31, 32; 91, 90.

Controls—Numerous controls were employed throughout. Not only did these testify to the chemical purity of the gelatin, in particular with respect to calcium, but in no instance did an antibody or reagin appear in any concentrate unless it was present in the original.

Discussion

The described method permits the separation of smaller, diffusible molecules from larger, nondiffusible ones; in this respect it resembles the methods of dialysis, ultrafiltration, and ultracentrifugalization. However, there are some important differences. As is well known, only a fraction of serum calcium is capable of traversing a dialysis membrane or an ultrafilter, while none of it enters swelling gelatin. Swelling gelatin seems to act in a different manner than dissolved gelatin; at any rate, it appears somewhat less permeable. The method permits the concentration of certain antibodies. In the determination of antibodies, dilutions of serum are commonly employed. The present method permits in a simple way extension of a series of dilution in a reciprocal direction, which might be useful in the case of weak concentrations of

antibodies or reagin. However, one should bear in mind that the general composition of the serum concentrated by the gelatin method is significantly altered, particularly with respect to the constituents present in colloidal state. The apparent discrepancy in the results obtained with the quantitative Kahn test and the Vernes test is noticeable. In 1926 Baylis, *et al.* (*1*) concluded in their paper dealing with the Vernes test: "The Vernes flocculation reading evidently depends, in part at least, upon other features of the patient's blood than does the Wassermann reading . . . " (p. 335). Epstein and Rubinstein (*2*) investigated the flocculation phenomena with syphilitic cerebrospinal fluids and expressed the opinion that the reagin is a relatively simple substance, unrelated to lipids or proteins. On the other hand, Vernes (*3*), who calls the reagin "Pallidine" and claims to have separated it from syphilitic serum, found that the substance did not pass through an ultrafilter, but that all of the active principle remained in the supernatant fluid after ultracentrifugalization of a solution for 17 hours at 86,000 r.p.m., while half of the solute was assembled at the bottom.

Summary

A method is presented whereby certain constituents of serum or other liquids may be concentrated by the swelling of undissolved gelatin. Applications to chemistry, to the study of antibodies, and to the serology of syphilis have been indicated.

Colloids, such as proteins and cholesterol, were found to be concentrated as expected. Chlorides also complied with expectation, fully entering the swelling gelatin. An anomaly was found with calcium in blood serum; all of it behaved like nondiffusible material, in contrast with known facts pertaining to dialysis and ultrafiltration.

References

1. Baylis, A. B., *et al.* *Amer. J. Syph.*, 1926, **10**, 292–337.
2. Epstein, E., and Rubinstein, H. *Koll. Z.*, 1926, **40**, 307–318; *Klin. Wschr.*, 1927, **6**, 209–212.
3. Vernes, A. *C. R. Acad. Sci.*, 1936, **203**, 684–685; 1937, **205**, 1437–1475; *Arch. Inst. Prophyl.*, 1939, **11**, 189; 272–274.

A Method for Obtaining Standard Suspensions of Tubercle Bacilli in the Form of Single Cells

W. F. Wells

Laboratories for the Study of Air-borne Infection
School of Medicine, University of Pennsylvania

A method devised to separate masses of organisms into single cells during culture (*1*) has proven singularly appropriate to the growth of the tubercle bacillus. Suspensions of singled tubercle bacilli produced by this method develop quantitatively on appropriate media. Aerosol suspensions of these singled organisms of the bovine strain, sampled by the air centrifuge and grown on these media, give counts of colonies corresponding quantitatively to the number of tubercles developing in the lungs of rabbits inhaling these suspensions. The production of standard suspensions of singled organisms is, however, only one example of the usefulness of the method. It provides favorable cultural conditions which adapt it to *in vitro* techniques such as the study of the effect of antibiotics upon this bacillus.

The apparatus used in this process simulates a tiny ball mill (Fig. 1). A 250-cc. Erlenmeyer flask, containing 50 pyrex glass beads 4 mm. in diameter and 50 cc. of culture fluid, is rotated about its axis at an angle such that the top surface of the flask is horizontal. This angle exposes a maximum surface of the medium which becomes continuous with the film lining the upper interior surface of the flask as it revolves. Floating cultures of tubercle bacilli are carried, as on a traveling belt, over the surface of the liquid itself, picked up on the film lining of the flask, and returned to the other edge of the liquid surface. An extensive, well-aerated, cultural surface supplied with nutritive fluid is thus provided; the culture itself is broken up into a myriad of small patches.

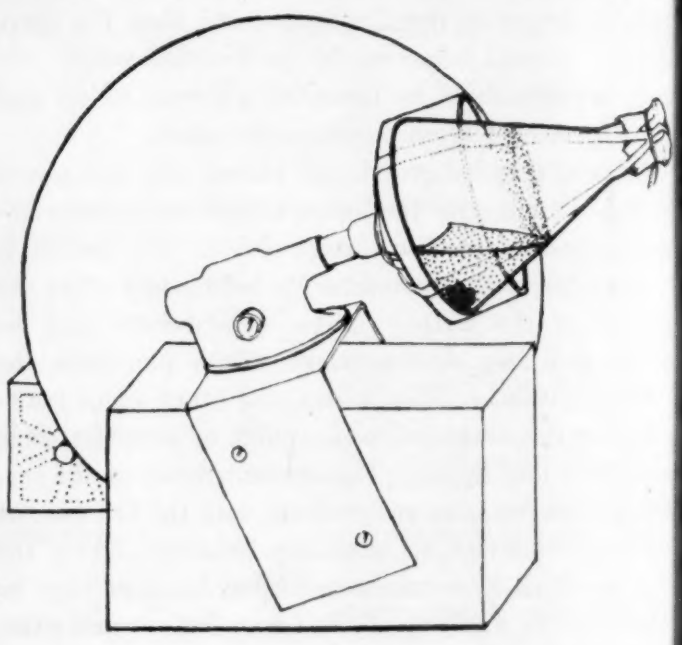


Fig. 1

After several days growth the culture begins to settle into the liquid, where it is subjected to a gentle grinding by the beads. This combination of subsurface culture with the gentle grinding produces an abundance of single cells which can be separated from the clumps by filtration through a No. 4 Whatman filter. The filtrate of singled organisms resembles broth cultures.

Transfer is also simplified: a bent glass rod dipped into the culture picks up patches from the surface which, because of the surface tension, immediately disperse over the surface of the inoculated fluid. A blend of equal parts of Difco nutrient broth, tryptose-phosphate broth, and brain-heart broth with 5 per cent glycerin was used as a culture medium.

In providing a standard suspension, a week-old culture is revolved a week. By such a schedule, 10,000,000–100,000,000 singled organisms per cubic centimeter are obtained in the filtrate. A steady biological state can thus be maintained for *in vitro* and *in vivo* experiments.

Reference

1. Wells, W. F., and Wells, M. W. *J. Amer. med. Ass.*, 1936, **107**, 1698–1703; 1805–1809.

Letters to the Editor

Comparative Digestibilities of Plastic Shortenings Made From Lard and From Hydrogenated Vegetable Oils

One of the most common popular beliefs which are stated as fact is that lard and other pork fats are less digestible than fats from other sources, such as beef fat, hydrogenated vegetable oils, etc. This misconception has persisted despite a tremendous amount of scientifically controlled experimental observations to the contrary. The most comprehensive studies, reported in Technical Bulletins from the Animal Nutrition Division of the U. S. Department of Agriculture (see R. Hoagland and G. G. Snider, *Tech. Bull. 821*), have shown that lard is significantly more digestible than either vegetable shortenings or blended vegetable and animal shortenings.

In the past two years a new type of shortening has been introduced which is made entirely of lard plasticized by the addition of hydrogenated lard and then deodorized to an entirely bland product, as is done in the case of vegetable shortenings. To prevent any suspicion that this bland lard shortening might be less digestible than a comparable all-vegetable shortening, the following feeding experiment was conducted.

The basic diet contained crude casein (18 per cent), dextrose (56 per cent), salt mixture (7 per cent), liver extract concentrate (3 per cent), brewers' yeast (1 per cent) and shortening (15 per cent). A control experiment using the above proportion of components without the shortening was run to determine the basal excretion of fat by the experimental animals.

Four groups of five albino male rats were started, two groups receiving the bland lard as the shortening portion and the other two groups receiving a well-known, all-vegetable shortening purchased at a retail store for this purpose. After a three-day orientation period on the experimental diets, all feces were collected and food consumption measured for seven days. The two groups receiving the bland lard diet were then changed over to the vegetable shortening diet and vice versa. Again there was a two-day transition period followed by a seven-day experimental period. Thus, each of the four groups was maintained for seven days on each of the two shortenings.

TABLE 1

Fat Ingestion and Excretion of Rats on Diets Containing Plastic Shortenings Made From Lard and From All-Hydrogenated Vegetable Oils

Animal group	A		B		C		D		All animals	
Shortening type	*Lard*	*Veg.*	*Lard*	*Veg.*	*Lard*	*Veg.*	*Lard*	*Veg.*	*Lard*	*Veg.*
Food consumption (grams)	444	494	480	484	493	472	430	431	1847	1881
Wt. fat in food (grams)	66.6	74.0	72.0	72.6	74.0	70.8	64.5	64.7	277.1	282.1
Wt. acidic extract (grams)	4.9	8.1	6.6	5.7	6.6	4.6	5.2	6.8	23.3	25.2
Corrected for low fat diet	3.7	6.9	5.4	4.5	5.4	3.4	4.0	5.6	18.5	20.4
X 1.045	3.9	7.2	5.6	4.7	5.6	3.5	4.2	5.8	19.3	21.3
Total fat undigested (%)	5.9	9.7	7.8	6.5	7.6	4.9	6.5	9.0	7.0	7.6
Digestibility (%)	94.1	90.3	92.2	93.5	92.4	95.1	93.5	91.0	93.0	92.4

The collected feces were crushed, saponified in methanol, acidified with 35 per cent H_2SO_4, and then extracted thoroughly with ether according to methods previously reported (see Hoagland and Snider; also K. F. Mattil and J. W. Higgins. *J. Nutrition*, 1945, **29**, 255–260). The extracts were washed with water, dried, freed of solvent, and then dried to constant weight. From the weight of the acidic residue obtained in each case was subtracted the corresponding amount of lipid obtained in the feces on the low fat diet. The difference was multiplied by the factor 1.045 to convert to glyceride weight. The digestibility coefficients were determined from the calculated weight of excreted glyceride and the total amount of experimental fat ingested (Table 1).

Examination of the literature indicates that two fats which are equally digested by rats will also be equally digested by humans. (This point will be elaborated further in a forthcoming review on the subject.) From

the data in Table 1 it is evident that the new plastic all-lard shortening and the well-known, all-hydrogenated vegetable shortening are equally digestible when fed to white rats. Therefore, they should be equally digestible in humans. The lard shortening has the added advantage that, due to the fact that the major portion is not hydrogenated, there has been no appreciable destruction of the naturally occurring, essential, unsaturated fatty acids. Thus it is evident that, although the lard-type shortening is probably nutritionally superior on the overall basis, both types of shortening are highly digestible and nutritious.

KARL F. MATTIL, JIM W. HIGGINS, and H. E. ROBINSON

Research Laboratories, Swift & Company
Chicago, Illinois

The Fireland Tribes of Chile

A Chilean Scientific Mission for the Study of the Fireland Tribes has recently finished field work begun in late January. The Mission was sponsored by the Universidad de Chile, the Dirección General de Informaciones y Cultura, the Museo Nacional de Historia Natural, and the Dirección General de Sanidad. The members of the Mission were: Gen. Ramón Cañas Montalva, geographical adviser; Alejandro Lipschutz, director of the Department of Experimental Medicine, chief of the Mission; Com. Lt. Col. Gustavo Luco, liaison officer of the Armed Forces and the Dirección General de Informaciones y Cultura; Grete Mostny, chief of the Department of Archaeology and Ethnography of the National Museum of Natural History; Juan Damiánovic, chief of the Health Service of the province of Magallanes; Fidel Jeldes, technician of anthropology of the Institute of Criminology of Chile; Hans Helfritz, cameraman of the Dirección General de Informaciones y Cultura; and Antonio Santiana, from the University of Quito, guest of Prof. Lipschutz. Louis Robin, member of the French Mission sent recently to Chile by the Musée de l'Homme, also took part in the work of the Mission. Mrs. Lipschutz accompanied the Mission. Work was greatly helped by the Armed Forces of Chile and especially by the Air Force. Mobilization was mostly by air. The members of the Mission flew over the Cordillera de Darwin to a clearing near the Bay of Yendegaia, where field work was begun. From there the Mission continued on the Argentine Navy patrol boat, "Zurubi," to work in various parts of the northern and southern shores of the Beagle Channel. This facility was generously offered by the Governor of Ushuaia. Adm. Portillos also rendered great help to the Mission.

The work for the Mission centered on (1) transculturation phenomena, including nosology, and (2) physical anthropology, including blood groups. These studies are urgent because of the great changes which have taken place in the whole tribal life of the Fuegians since Martin Gusinde finished his classical field work 20 years ago and because these tribes are on the way to rapid extinction.

The Mission has studied about two-thirds of the individuals known to be members of the Yámana (Yáhgans) tribe, who live mostly on the island of Navarino. On the Isla Grande the Mission examined half of the individuals of the tribe of Onas, including mestizos, who live mostly near Rio Grande on the Atlantic border of the Isla Grande. An inquiry was also made about the remaining half of individuals of Ona extraction who live around Lago Fagnano, where the Mission was unable to go because of poor roads and lack of lodging. Various members of the third Fireland tribe, the Alakalufs, also were studied. Only 17 Alakalufs, or Alakaluf mestizos, were accessible, since the majority of them wander in their canoes in the channels of the South.

The results obtained were of great interest from the point of view of acculturation in its different aspects and also from the point of view of physical anthropology. Blood groups were determined in 20 individuals of Ona extraction (half of the whole population), 40 of Yámana extraction (two-thirds of the whole population), and 17 of Alakaluf extraction. In all three tribes about 75 per cent were of Group O, contrary to what was found formerly by Rahm in Yámana, most of whom, he stated, were of group B. Since the Mission studied most rigorously the genetic antecedents of all the individuals available, it was possible to establish that all the individuals who do not belong to Group O had some white ancestry which the Mission was able to trace, in almost all cases, to parents or grandparents of the respective individuals. The Mission came to the conclusion that the Fuegians, like the American Indians in general, belong to Group O, and that the presence of Groups A, B, and AB is due to infiltration of the respective blood factors through miscegenation with whites. Different cases of "ethnic mutation" also were studied with special reference to the social factors responsible. Informative films and especially documentary films of the facial typology of the Fuegians were made.

A group of the Mission, including Prof. and Mrs. Lipschutz, Dr. Mostny, and Mr. Helfritz, flew over the islands and Cape Horn to complete their knowledge about the most southern zone visited by the wandering Indians in their fishing and hunting expeditions.

Results, together with ample photographic material, will be published in a series of papers.

A. LIPSCHUTZ

Avenida Irarrázaval 849, Santiago de Chile

On Opinions of the International Commission on Zoological Nomenclature

William F. Rapp, Jr. (*Science*, 1945, 102, 17) has outlined the story behind the Meigen names that for 38 years have confused the orderly progress of dipterists in their work. But the criticism of the Opinions of the International Commission is based on misunderstandings that should be clarified.

In issuing Opinion 28 in 1910, the Commission did the only thing then within its power: decided whether or not the paper was published under the meaning of the code. It had no power to make exceptions, and it did decide on what it believed to be conclusive evidence, that the

paper had been duly published; hence the names were on the same status as those in any other paper. Having so decided, it could not answer Dr. Aldrich's question of whether the 1800 names were valid, because that embraced as many taxonomic questions as there were names involved, did not fall in the province of nomenclature, and lay outside the scope of the Commission.

The results of Mr. Edwards' 1932 questionnaire were never laid before the Commission, nor was the Commission asked to take any action by Mr. Edwards.

But in 1932 the Fifth International Congress of Entomology adopted (with dissenting voices) a four to two majority resolution of its Committee on Nomenclature and transmitted it to the International Commission on Zoological Nomenclature for action. This resolution definitely recommended that the names of Meigen (1800) be sustained. I was present at that Committee meeting and was, I think, one of the two who voted against the resolution, but I do recall that it was championed by an eminent dipterist.

The resolution presented an impossible request to the International Commission. No such body could properly establish a blanket validation of any long list of generic names, least of all names with which no species had originally been connected, and the correct application of which could therefore individually be highly debatable on zoological rather than nomenclatorial grounds. The Commission has always followed a policy of refusing to act on blanket requests.

In Opinion 152 (adopted in 1935) the Commission politely refused to accede to the request of the Fifth International Entomological Congress. The explanation of the situation by Secretary Hemming, published in the Opinion, is very clear. The Commission went further and advised dipterists or others interested that they would welcome petitions to suspend the rules in any given case where the Meigen names cause confusion.

It is no part of the function of the Commission to initiate such action, or any action. Its function is judiciary and may be likened to that of the Supreme Court of the United States in interpreting the meaning of our Constitution as applied to individual situations that may arise. It would be a woeful ignorance of judicial procedure that would expect our Supreme Court on its own initiative to seek out dubious situations and to render a decision covering them.

The blame for the confusion in regard to the Meigen names falls squarely on the shoulders of dipterists. Had any one of them, after the Commission was given authority to suspend the rules (by the Ninth International Congress of Zoology, 1913), presented petitions to the Commission requesting suspension of the rules in regard to any or each of the Meigen names that are found obnoxious, each petition individually would have been acted upon, and by now the names involved would either have been definitely adopted, or rejected in favor of certain others. Even Edwards, after taking the pains to circularize dipterists as to their opinion upon the Meigen names en masse, never requested any action of the Commission either upon the names en masse (which probably would not have been considered) or upon them individually, which certainly would have been.

A similar situation arose in Hymenoptera. There the so-called Erlangen list and other considerations threatened a grand stirring around of family names. The undersigned prepared a series of petitions to the Commission, each covering a single name or series of interdependent names, some involved in the Erlangen list, others not involved. He sent copies to all working hymenopterists known to him and asked them either to sign or to indicate their disapproval. These petitions, with signatures and comments, were presented to the Commission, have all been acted upon, have all but one been granted by the Commission, and as a result we have available for use the family names in Hymenoptera that the usage of the 19th Century established. Blame for the fact that dipterists are not as well off cannot be fairly laid to the Commission.

J. CHESTER BRADLEY
Cornell University, Ithaca, New York

Successful Interchange of Ovaries Between Albino Rats and Mice

The present note deals with transplantation of entire rat ovaries into mice and vice versa. Each ovary was "shelled out" of the ovarian bursa, removed intact, and inserted into a corresponding location in the recipient. Excised ovaries were simply exchanged between adult rat and adult mouse. Both unilateral and bilateral implants were made. Approximately seven weeks later the transplants and (when present) the original undisturbed ovary of the opposite side were examined histologically. All implants had persisted, and all had an excellent blood supply. In several of the rat ovaries which had been implanted into mice there was regression, although some contained developing follicles in various stages. Some of the mouse ovaries, which had been implanted into rats appeared cystic, as from overstimulation. It is suggested that the large mass of adult rat ovarian tissue is insufficiently stimulated by the mouse pituitary, while the rat pituitary overstimulated the relatively smaller adult mouse ovaries.

One rat delivered a normal litter of seven young 18 days after receiving two mouse ovaries in substitution for her own. She failed to lactate. One mouse which received a unilateral substitution had a litter of seven apparently normal young 12 days later and also failed to lactate. Experiments are being continued.

JAMES M. SANDERS
Department of Anatomy, University of Missouri, and
Department of Science, Chicago Teachers College

Lomonósov and the Concept of Heat

My attention has been called to an article (*Science*, 1945, 103, 487) in which the author feels that insufficient tribute has been paid to M. V. Lomonósov and states that his name has never been mentioned in the European and the American scientific literature in connection with the development of our concept of heat.

May I call your attention to Moore's *History of chemistry* (3rd ed.), in which there is a full-page picture of Lomonósov, followed by three pages in tribute to him. On page 61 it is stated: "Lomonósov can be called the first real physical chemist because he looked at chemistry from the standpoint of physics and mathematics; his ideas were at least 100 years in advance of his time." The text goes on to give his views in regard to heat and pays tribute to his other various advanced ideas.

This textbook is widely used in the colleges and universities of the United States, so I feel the statement in the published article must be in error.

LEROY S. WEATHERBY
Department of Chemistry
University of Southern California

Book Reviews

Diseases of the skin. **(3rd ed.) George Clinton Andrews. Philadelphia-London: W. B. Saunders, 1946. Pp. vi + 937. (Illustrated.) $10.00.**

This book constitutes a thorough revision of the author's textbook on dermatology, and, as Andrews states, "more than sixty new skin diseases have been added to the text."

The present book is an excellent text for undergraduate and postgraduate students of dermatology as well as for the general practitioner. Far less voluminous than the first edition, it offers a more balanced discussion of the various phases of this speciality with less emphasis on theory and more emphasis on practical aspects. In addition to the inclusion of many new diseases of the skin, the book is up to date in the discussion of advances in therapy such as penicillin, the sulfonamides, streptomycin, and new X-ray apparatus.

In the first edition entirely too much space was devoted to the theory and physics of X-ray and radium therapy. In the current edition the author has limited his own discussion of these therapeutic agents to 20 pages, yet the subject is adequately covered. Of value to the dermatologist who desires a more complete knowledge of Roentgen-ray physics as applied in dermatology is Chapter 35, by Carl B. Braestrup.

The discussion of skin diseases due to fungi (64 pp.) is particularly valuable in view of their prevalence. Many of the larger cities in the United States are having the greatest epidemic of tinea capitis in their history, and Andrews' discussion of the therapy of ringworm of the scalp is particularly helpful.

Especially worthy of mention is the excellent discussion of the therapy of each disease. The prescriptions are excellent and are brought up to date by being rewritten entirely in the metric system.

It has been said that "one picture is worth a thousand words." The illustrations in Andrews' text are excellent and well reproduced. The author has not hesitated to draw upon dermatologists throughout the country in order to obtain the best photographs of skin diseases available.

If there is any criticism of the book, it might be directed toward the extremely brief discussion of cutaneous neuroses. With the increased attention directed toward the psychosomatic aspects of disease in general, it would seem desirable to give more than a page and a quarter to a discussion of the neurogenic aspects of skin diseases.

CARROLL S. WRIGHT
1402 Spruce Street, Philadelphia, Pennsylvania

Forest tree breeding and genetics. **R. H. Richens. (Imperial Agricultural Bureaux Joint Publication No. 8.) Cambridge, Engl.: Imperial Bureau of Plant Breeding and Genetics, 1945. Pp. viii + 79. 5s.**

Although the results of forest tree breeding and genetics research have proceeded to only a limited degree toward the point of practical application, literature in the field has multiplied greatly in recent years. This publication performs a signal service for the research worker by bringing together and collating literature from all sources appearing from 1930 through 1944. As pointed out in a foreword by H. G. Champion, "There is no publication bringing together for the use of the forester all the information which already exists in this important field, and it is to fill this gap that this technical communication has been compiled."

Following an orienting introduction, progress and problems in the general field of forest genetics are analyzed and documented at some length under 22 subject matter captions.

The bibliography includes over 600 titles and seems very complete. Besides being arranged alphabetically, it is collated for 9 gymnosperm genera and 22 angiosperm genera. Each genus is characterized as to its species, genetical nature, and status of research. For example, *Pinus* is discussed and documented in regard to natural variation, effects of environment, genetical analysis, cytology, timber yield, photoperiod, efficiency of reproduction, shape, quality, competition, temperature, fungi, insects, hereditary defects, selection, hybridization, induced mutation, and pollination.

Another feature is a glossary of some 300 terms defined with respect to their significance for forest tree breeding.

From start to finish the publication is planned to be of maximum usefulness to the forest geneticist and should be available to every serious worker in the field.

KENNETH P. DAVIS, *Dean*
School of Forestry, Montana State University
Missoula